Journal of Clinical & Analytical Medicine
Original Research

The effect of using a larger port on reducing the complications of laparoscopic cholecystectomy: A randomized trial

Osman Toktas[1], Oztekin Cıkman[1], Caghan Peksen[1], Sadi Elasan[2], Nurettin Yuzkat[3]
[1]Department of General Surgery, [2]Department of Biostatistics, [3]Department of Anesthesiology and Reanimation, Yuzuncu Yıl University, Faculty of Medicine, Van, Turkey

Abstract

Aim: Laparoscopic cholecystectomy (LC) is the gold standard treatment method for cholelithiasis. There are many complications related to LC and many different microinvasive interventions have been performed to decrease the complication rate. In this study, we aimed to demonstrate the surgical results of the LC that was performed with a 15-mm port tool. Material and Method: Two-hundred patients who underwent LC in our clinic were included in this study. These cases were randomized as 10-mm port tool group (n=100) and 15-mm port tool group (n=100) according to the port-tool diameter that was used in LC. The gallbladder extraction time, port site complications, length of hospital stay, postoperative pain and cosmesis scores were compared between two groups.Results: The gallbladder extraction time was 135.3 sec in the 10-mm port tool group and 13.4 sec in the 15-mm port tool group ($p<0.05$). The complication rate was 53% (53cases) in the 10-mm port tool group and 13% (13cases) in the 15-mm port tool group ($p<0.05$). The duration of hospitalization was the same in both groups. The port site pain was 5.4 (2–9) in the 10-mm port tool group and 4.3 (1-7) in the 15-mm port tool group ($p<0.05$). None of the patients in either group had port site hernias or infections, and there was no significant difference between the two groups with regard to the port site incision scarring. Discussion: It was thought that it can reduce the operation time, the need for fascial expansion, gallbladder perforations during removal, and postoperative port site pain. Moreover, it does not increase the risk of a port site infection or a hernia and is not different from wound scarring.

Keywords

Gallbladder Perforation; Laparoscopic Cholecystectomy; 15-mm Port

DOI: 10.4328/JCAM.6150 Received: 01.01.2019 Accepted: 24.01.2019 Published Online: 27.01.2019 Printed: 01.05.2019 J Clin Anal Med 2019;10(3): 311-5
Corresponding Author: Osman Toktas, Department of General Surgery, Yuzuncu Yıl University, Faculty of Medicine, Van, Turkey.
GSM: +905053088996 E-Mail: osmantoktas@windowslive.com
ORCID ID: 0000-0003-1277-1358

Introduction

The laparoscopic cholecystectomy (LC) was performed and described for the first time by Dr. Erich Mühe [1]. Since the introduction of this procedure, LC has been preferable to open surgery because of short hospital stay and lesser perioperative complications. LC is considered a gold standard treatment method to eradicate chronic gallbladder disease and extract gallstones [2]. Many microinvasive techniques were described to decrease the cost of the operation and to decrease the morbidity rates [3-5]. Even if conventional LC is performed via 4 trocars, single incision LC (SILC) was performed by different authors to provide satisfied outcomes for the surgeons and the patients [6,7]. Beside this, with the developments in the health science, robotic technology was used in laparoscopic surgery to provide successful outcomes [8].

Bile duct injury, spillage of the bile and gallstones, bleeding, port-site infection, port-site hernia, and poor wound healing are considered as the most common intraoperative and postoperative complications [1,9,10].

According to our observation, using a larger port tool provided more comfortable operation especially during extraction of the gallbladder. In this study, we aimed to demonstrate our LC outcomes that were performed with a 15-mm port tool and to compare the outcomes of the standard and the larger port tool.

Material and Method

This prospective randomized controlled study was performed after obtaining approval from the local ethics committee. Sixty patients who underwent LC due to cholelithiasis in a tertiary clinic between January 2017 and December 2017 were included in this study. All patients were informed about the study and written informed consents were obtained from all participants. The patients were randomized into 2 groups as 10-mm port group and 15-mm port group according to the diameter of the port tool that was used in the LC. There were no inclusion and exclusion criteria for the patients in each group and the patients were sequentially included in the groups. There were 30 patients in each group. The 10-mm port tool group included the patient who had multiple gallstones (Figure 1a). On the other hand, there were patients with acute cholecystitis (Figure 1b) and 3 patients with large (1.5–2 cm) stones (Figure 1c) in the 15-mm port tool group.

Both groups underwent 3-port LCs under general anesthesia, consisting of a 10-mm port in the supraumbilical region for the camera, and a 5-mm port in the umbilicus line located on the right pararectal line for the tool. A 10-mm port was used under the xiphoid to take out the gallbladder in the 10-mm port tool group; a 15-mm port was used in the 15-mm port tool group. Any extraction bag was not used for extraction of the gallbladder. In both groups, at the end of the surgery, in case of the port locations ≥ 10 mm, they were closed with 1-0 polyglactin sutures (Ethicon).

The two groups were compared with regard to gallbladder extraction time, postoperative pain score, port-site fascial expansion, gallbladder perforation, length of hospital stay, the presence of a port-site infection, cosmesis score (wound healing), the presence of the port-site hernia. The duration between completion of the gallbladder dissection and taken out of the gallbladder from abdomen to outside was considered as gallbladder extraction time. Patients were treated with 500 mg paracetamol (IV) for every 6 hours to prevent postoperative pain. On a postoperative day 1(24th hour), patients scored their pain with VAS score from 0 to 10 (0=no pain and 10=unbearable pain). Beside this, the patients evaluated their cosmesis with the VAS score (0: the best, 10: the worst) (Figure 2a, 2b). The presence of the complications was recorded for each group.

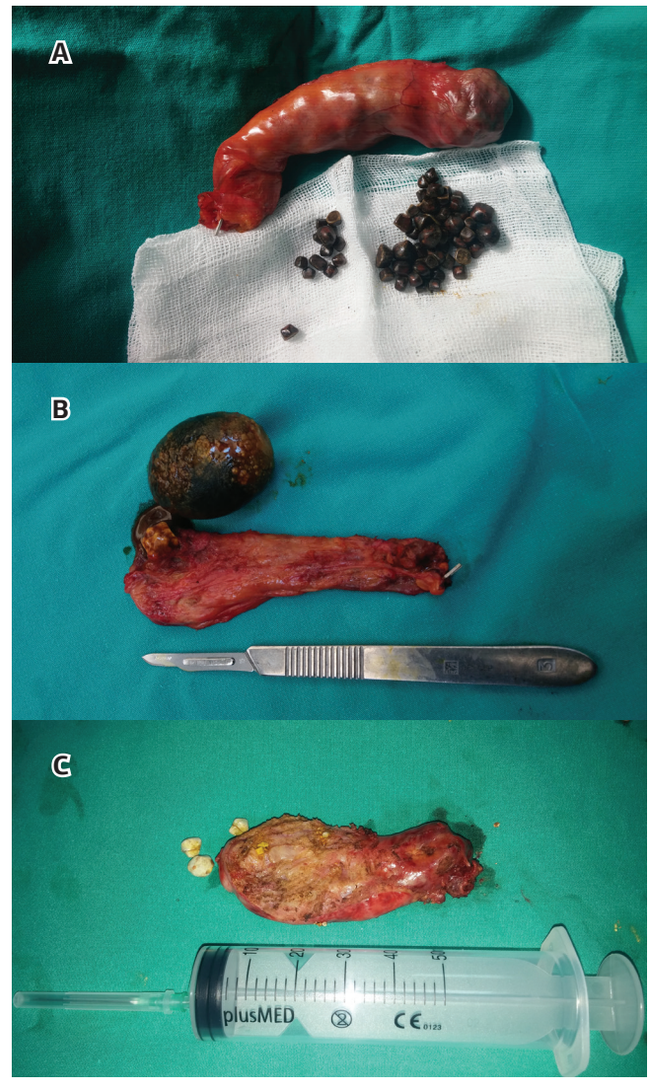

Figure 1. Cholelithiasis, 10-mm port (A). Cholelithiasis, 15-mm port (B). Cholecystitis, 15-mm port (C).

Statistical Analysis

The categorical variables were described as a number (n) and percent (%), while the continuous variables were expressed as the mean ± standard deviation, confidence interval (95%), and minimum and maximum values. The continuous variables were compared using the Student's t-test. The Mann-Whitney U test was used to compare the pain scores. All of the statistical analyses were performed using the Statistical Package for the Social Sciences for Windows version 23 (SPSS Inc., Chicago, IL, USA) and the statistical significance level was 5%.

Results

The mean age of the 10-mm port tool group was 48.96 years (range 18-76 years), and there were 81 females and 19 males.

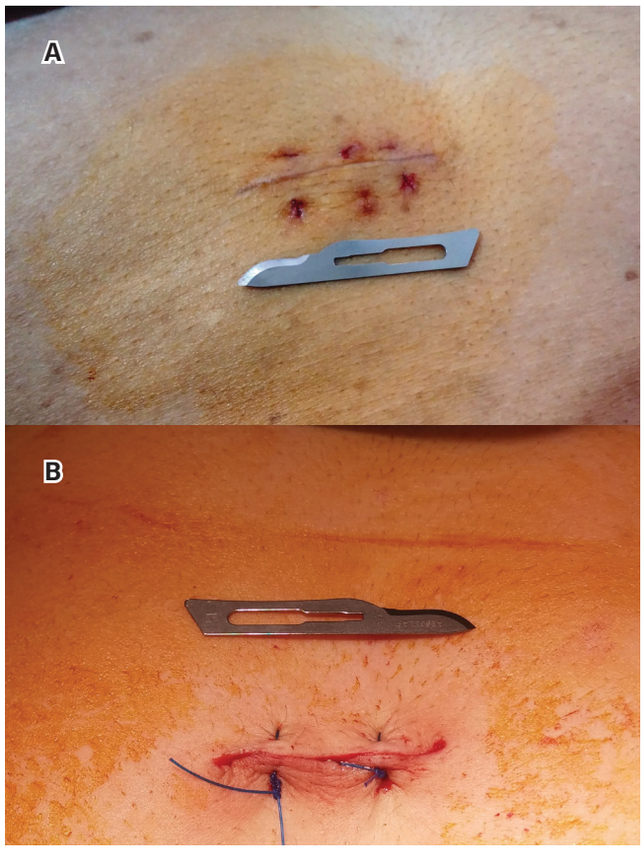

Figure 2. Port site scar, 10-mm port (A). Port site scar, 15-mm port (B).

In the 15-mm port tool group, the mean age was 46.66 years (19-73), and there were 83 females and 17 males (Table 1).

The gallbladder extraction time was 135.3 sec (4-780) in the 10-mm port tool group and 13.4 sec (2-75) in the 15-mm port tool group (p=0.01) (Table 1).

Postoperative pain scores were higher in 10-mm port tool group compared to 15-mm port tool group, and the difference was statistically significant (Table 1).

The rate of the complications due to LC was higher in the patients who underwent LC with 10-port tool (Table 1). Gallbladder perforation was significantly higher in 10-mm port tool group (Relative risk: 3.5; 95% CI: 0.791-15.495) (Table 1). Port site enlargement was performed in 37 patients of 10-mm tool port group (Relative risk: 9.5; 95% CI: 2.423-37.248). VAS scores related to cosmesis were 3.2 ± 1.2 in 10-mm port tool group and 2.9 ± 1.1 in 15-mm port tool group (Table 1).

No bleeding, port-site hernia, and port-site infection were observed in this study. The time of hospital stay was equal for each patient.

Table 1. Patient characteristics and surgical outcomes.

	10-mm port tool	15-mm port tool	P-value
Age (mean-range)	48,96 (18-76)	46,6 (19-73)	0.276
Gender (n)	F/M: 19/81	F/M: 17/83	
Gallbladder Extraction Time (sec)	135.3 (range 4-780)	13.4 (range 2–75)	0.001
Port site pain on postoperative day 1	5.4±1.7 (range 2–9)	4.3±1.3 (range 1–7)	0.010
Gallbladder perforation	10 (10%)	0 (6.6%)	0.001
Port site enlargement	37 (37%)	0 (6.6%)	0.001
Cosmesis	3.2±1.2	2.9±1.1	0.929
Length of hospital stay	1 day for each patient	1 day for each patient	
Early or late port site infection	No	No	
Port site hernia (12-month follow-up)	No	No	

Discussion

Minimal invasive cholecystectomy is very important to reduce the postoperative pain, hospital stay, cosmetic problems. Especially less pain and minimal incision scar are the key points for better life quality. Conventional LC is performed with 4 trocars and many authors demonstrated that single port incision provides less pain and less cosmetic problems [4-6]. Hajong et al. stated that analgesic requirement in the patients who underwent single port LC was significantly lesser compared to conventional LC patients [1]. Also, they have mentioned satisfactory cosmetic results in the patients with single port LC [1]. On the other hand, use of the single port for LC led to increasing of operation time compared to conventional LC [11]. It was reported that increased operation time was associated with decreased concentration and increased surgical failure [12]. In our present study, there was no difference between the groups with respect to total operation time, cosmetic results and pain scores. But, gallbladder extraction time was significantly higher in the 10-mm tool group compared to 15-mm tool group. Port site is smaller than gallbladder and this situation may lead to prolongation of the extraction time. To extract complicated gallbladder or to remove big stones, longer incisions may be required. Beside this, there is a risk of spillage bile and stone in case of forced extraction [13]. Judge et al. developed a retraction device to extract gallbladder and they have mentioned less extraction times in case of using that device in LC [9].

Gallstone spillage into the peritoneal cavity during an LC is often seen due to gallbladder perforation. It was mentioned that the gallstone spillage rate was 22.1% in a very comprehensive review [14]. Gallstone spillage in case of infection may lead to peritoneal inflammation and local abscess [15]. The missed stones in the peritoneal cavity can also be a reason for the conversion to open surgery. In our study, the perforation rate was 10% (10 cases) in the 10-mm tool port group. Increased spillage rate was demonstrated in the operations that were performed in the patients with inflamed gallbladder [16]. Although it was performed in more challenging cases, the rate of gallstone spillage was less in the patients who were operated with 15-mm tool port in our study. According to our observation, the larger tool port helps the surgeon to extract the gallbladder easier due to the fact that it provides better manipulation area.

The port site expansion rate was 37% (37 cases) in the 10-mm port tool group and we did not need any port site expansion in the 15-mm port tool group. Enlargement of the fascial incision may be the reason for a port-site hernia [17]. Alptekin et al. demonstrated lower port-site hernia incidence in conventional LC compared to single-port LC [18]. They stated that poor ergonomic operation may increase the fascial expansion and port-site hernia [18]. The fascial closure is crucial to prevent a port-site hernia [19]. Bunting suggested suturing the fascial defect with an absorbable suture to reduce hernia risk [20]. The port site hernia incidence has been reported to range between

0.14% and 22% in laparoscopic procedures [3,21]. A port incision extension, preexisting fascial defects, no port site closure, and the trocar diameter are important factors. Duca et al. [22] included port site hernia patients in their study and determined that these patients had wound infections and extended incision sites due to large calculi. In our study, the port sites ≥ 10 mm were routinely closed with sutures in both groups, and at the 12-month follow-up, no port-site hernias were observed in any of our patients.

Chang et al. [10] compared single-incision laparoscopic cholecystectomies (SILCs) and conventional four-port LCs, and the pain scores in the umbilical and extra umbilical regions were significantly lower in the SILC cases [23]. On the other hand, there was no significant difference between SILC and 3-port LC in respect to postoperative pain [21]. In a large review, it was stated that lower postoperative pain scores were observed in mini-instrument LC patients compared to single-port LC patients [10]. In our study, the postoperative pain scores were significantly lower in the 15-mm port tool group. The manipulations at the port site and fascial expansion process may be the reason for higher pain scores.

Even though an LC has many advantages, incisional infections can develop in this operation. A wound site infection usually develops where the gallbladder is removed from the abdomen [24]. The port site infection rate after an LC varies between 0.4% and 9.1% [25]. In our study, wound infections did not develop in either group. We attributed this to the fact that our patient group was low and there were more cholelithiasis cases.

There were some limitations in this study. The number of patients was limited. We did not measure the Body Mass Index of the patients in this study. Also, we did not compare the single-port LC and 15-mm port tool group.

Conclusions

LC complications must be neither exaggerated nor underestimated. All of the steps are important in an LC, which is frequently performed in surgical clinics. Sometimes, small complications can be annoying and affect the motivation of the surgical team throughout the operation. Especially in cases with large calculus numbers and sizes or in cases with cholecystitis, the use of a 15-mm port can shorten the gallbladder extraction time, reduce the expansion of the port site incision, reduce the rate of gallbladder perforations, and reduce the port site pain level. According to our randomized prospective study, use of the large port can be considered as a reliable method in the LC. We need a larger number of studies to obtain more informative data about this technique.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Reynolds W Jr. The first laparoscopic cholecystectomy. JSLS. 2001; 5: 89-94.
2. Sun S, Yang K, Gao M, He X, Tian J, Ma B. Three port versus four port laparoscopic cholecystectomy: meta-analysis of randomized clinical trials. World J Surg. 2009; 33(9): 1904-08.
3. Soper NJ. Cholecystectomy: from Langenbuch to natural orifice transluminal endoscopic surgery. World J Surg. 2011; 35(7): 1422-27.
4. Erbella JJ, Bunch GM. Single incision laparoscopic cholecystectomy: the first 100 outpatients. Surg Endosc. 2010; 24(8): 1958-61.
5. Arezzo A, Scozzari G, Famiglietti F, Passera R, Morino M. Is single-incision laparoscopic cholecystectomy safe? Results of a systematic review and meta-analysis. Surg Endosc. 2013; 27: 2293-304.
6. Geng L, Sun C, Bai J. Single incision versus conventional laparoscopic cholecystectomy outcomes: a meta-analysis of randomized controlled trials. PLoS One. 2013; 8.DOI:10.1371/journal.pone.0076530
7. He GL, Jiang ZS, Cheng Y, Lai QB, Zhou CJ, Liu HY, et al. Tripartite comparison of single-incision and conventional laparoscopy in cholecystectomy: A multicenter trial. World J Gastrointest Endosc. 2015; 7: 540-6.
8. Han C, Shan X, Yao L, Yan P, Li M, Hu L, et al. Robotic-assisted versus laparoscopic cholecystectomy for benign gallbladder diseases: a systematic review and meta-analysis. Surg Endosc. 2018 Nov; 32: 4377-92.
9. Ros A, Carlsson P, Rahmqvist M, Backman K, Nilsson E. Nonrandomized patients in a cholecystectomy trial: characteristics, procedure, and outcomes. BMC Surge. 2006; 6:17.
10. Chang SK, Wang YL, Shen L, Iyer SG, Madhavan K. Interim report: a randomized controlled trial comparing postoperative pain in single-incision laparoscopic cholecystectomy and conventional laparoscopic cholecystectomy. Asian J Endosc Surg. 2013; 6: 14-20.
11. Garg P, Thakur JD, Garg M, Menon GR. Single- incision laparoscopic cholecystectomy vs. conventional laparoscopic choolecystectomy: a meta-analysis of randomized controlled trials. J Gastrointes Surg. 2012; 16(8): 1618-28.
12. Trastulli S, Cirocchi R, Desiderio J, Guarino S, Santoro A, Parisi A, et al. Systematic review and meta-analysis of randomized clinical trials comparing single-incision versus conventional laparoscopic cholecystectomy. Br J Surg. 2013; 100(2): 191-208.
13. Holme JB, Mortensen FV. A powder-free surgical glove bag for retraction of the gallbladder during laparoscopic cholecystectomy. Surg Laparosc Endosc Percutan Tech. 2005; 15(4): 209–11.
14. Shamiyeh A, Wayand W. Laparoscopic cholecystectomy: early and late complications and their treatment. Langenbecks Arch Surg. 2004; 389: 164-71.
15. Rooh-ul-Muqim, Qutab-e-Alam Jan, Zarin M, Aurangzaib M, Wazir A. Complications of laparoscopic cholecystectomy. World J Laparoscopic Surg. 2008; 1: 1-5.
16. Schafer M, Suter C, Klaiber C, Wehrli H, Frei E, Krahenbühl L. Spilled gallstones after laparoscopic cholecystectomy. A relevant problem? A retrospective analysis of 10,174 laparoscopic cholecystectomies. Surg Endosc. 1998; 12: 291–3.
17. Helgstrand F, Rosenberg J, Bisgaard T. Trocar site hernia after laparoscopic surgery: A qualitative systematic review. Hernia. 2011; 15: 113–21.
18. McKinley SK, Brunt LM, Schwaitzberg SD. Prevention of bile injury: the case for incorporating educational theories of expertise. Surg Endosc. 2014; 28: 3385-91.
19. Nassar AH, Ashkar KA, Rashed AA, Abdulmoneum MG. Laparoscopic cholecystectomy and the umbilicus. Br J Surg. 1997; 84: 630–3.
20. Geraci G, Sciume C, Pisello F, Volsi FL, Facella T, Modica G. Trocar-related abdomnal wall bleeding in 200 patients after laparoscopic cholecystectomy: personal experience. J Gastroenterol. 2006; 12: 7165-7.
21. Boldo E, Perez de Lucia G, Aracil JP, Martin F, Escrig J, Martinez D, et al. Trocar site hernia after laparoscopic ventral hernia repair. Surg Endosc. 2007; 21: 798-800.
22. Duca S, Bala O, Al-Hajjar N, Lancu C, Puia IC, Munteanu D, et al. Laparoscopic cholecystectomy: incidents and complications. A retrospective analysis of 9542 consecutive laparoscopic operations. HPB. 2003; 5: 152-8.
23. Radunovic M, Lazovic R, Popovic N, Magdelinic M, Bulajic M, Radunovic L, et al. Complications of laparoscopic cholecystectomy: Our experience from a retrospective analysis. Open Access Maced J Med Sci. 2016; 4: 641-6.
24. Yano H, Okada K, Kınatu M, Iwazawa T, Kanoh T, Monden T. Use of non-powder surgical glove for extraction of gallbladder in laparoscopic cholecystectomy. Digestive Endoscopy. 2003; 15: 315-9.

25. Girgin M, Kanat BH, Ayten R, Çetinkaya Z. Effects of endobag usage on port site infections in acute cholecystitis. Dicle Medical J. 2012; 39: 27-30

How to cite this article:
Toktas O, Cıkman O, Peksen C, Elasan S, Yuzkat N. The effect of using a larger port on reducing the complications of laparoscopic cholecystectomy: A randomized trial. J Clin Anal Med 2019;10(3): 311-5.